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09/901,038	07/10/2001	Toshihiro Yamashita	50090-301	6404

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EXAMINER

CROWELL, ANNA M

ART UNIT	PAPER NUMBER
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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/901,038
Filing Date: July 10, 2001
Appellant(s): YAMASHITA ET AL.

Scott D. Paul
For Appellant

EXAMINER'S ANSWER

MAILED
OCT 19 2004
GROUP 1700

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This is in response to the appeal brief filed August 3, 2004.

(1) *Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct.

Claims 1-18 are pending in this application. Claims 1-7 stand finally rejected. Claims 8-18 are withdrawn from consideration.

(4) *Status of Amendments After Final*

No amendment after final has been filed.

(5) *Summary of Invention*

The summary of invention contained in the brief is generally correct.

The present invention is directed to a plasma processing apparatus. The apparatus comprises a processing chamber, a pair of electrodes, an RF feeding apparatus, a

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retaining/removal apparatus, and a detection apparatus. The detection apparatus detects the electrostatic-chucking state of the substrate and the detecting removal state of electrical charges from the substrate, on the basis of variations in impedance arising between the sample table and the substrate. As a result of the use of the detection apparatus, there is stable processing and transport of a wafer, improved throughput attributable to shortening of a wafer dechucking time, an optimal electrostatic chucking voltage, and stable dechucking of a wafer and removal of electrical charges.

(6) *Issues*

The appellant's statement of the issues in the brief is substantially correct. The issues are if:

1. Claim 1 is anticipated under 35 U.S.C. 102(b) by Akihiro (JP 07-240458).
2. Claims 1-2, 4, and 7 are anticipated under 35 U.S.C. 102(b) by Deguchi et al. (U.S. 5,665,166).
3. Claims 3 and 5-6 are unpatentable under 35 U.S.C. 103(a) over Deguchi et al. (U.S. 5,665,166) in view of Collins (U.S. 5,874,361).
4. Claim 1 is unpatentable under 35 U.S.C. 103(a) over Sotozono (JP 62-054637) in view of Akihiro (JP 07-240458).

(7) *Grouping of Claims*

Claims 1-7 stand or fall together.

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(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

07-240458	AKIHIRO	01-1994
5,665,166	DEGUCHI ET AL.	09-1997
5,874,361	COLLINS ET AL.	02-1999
62-054537	SOTOZONO	03-1987

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Akihiro (Japanese Patent Publication 07-240458).

Referring to the Drawing 4, abstract, and paragraphs [0020]-[0026], Akihiro discloses a plasma processing system comprising: a processing chamber 11 into and from which processing gas is inlet and outlet; a pair of electrodes 13, 14 disposed so as to mutually oppose within the

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processing chamber; a RF feeding apparatus 15 for generating plasma between the pair of electrodes [0026]; a retaining/removal apparatus 12, 17 for retaining a substrate 18 to be processed on and removal from a sample table while one of the pair of electrodes 13 is taken as the sample table; and a detection apparatus 41 for detecting the electrostatic-chucking state of the substrate and for detecting removal state of electrical charges from the substrate, on the basis of variations in impedance arising between the sample table and the substrate. Additionally, the detection apparatus 41 has an impedance detection circuit 46 connected to a power line of the RF feeding apparatus 15 by way of a voltage probe 45. Furthermore, the retaining/removal apparatus includes a DC application apparatus 16 for applying a DC voltage to the sample table.

3. Claims 1, 2, 4, and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Deguchi et al. (U.S. 5,665,166).

Referring to the Figure 7, column 4, line 54-column 6, line 48, and column 9, line 26-column 11, line 4 discloses a plasma processing system comprising: a processing chamber 1 into and from which processing gas is inlet 24 and outlet 1a (col. 6, lines 37-48); a pair of electrodes 21, 7 disposed so as to mutually oppose within the processing chamber (col. 5, lines 1-7, col. 6, lines 29-36); a RF feeding apparatus 11 for generating plasma between the pair of electrodes (col. 5, lines 16-22); a retaining/removal apparatus 8, 32 for retaining a substrate W to be processed on and removal from a sample table while one of the pair of electrodes 7 is taken as the sample table; and a detection apparatus 53 for detecting the electrostatic-chucking state of the substrate and for detecting removal state of electrical charges from the substrate, on the basis of variations in impedance arising between the sample table and the substrate.

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With respect to claim 2, the plasma processing system further includes a detection apparatus 53 has an impedance detection circuit 52, 63 connected to a power line of the RF feeding apparatus 11 and the power line of the retaining/removal apparatus 17 by way of a voltage probe 61, the impedance detection circuit detecting plasma impedance stemming from variations in the length of a gap between the sample table and the substrate, the impedance detection circuit detecting an electrostatic chucking failure or the end of removal of electrical charges (col. 10, lines 45-52). Furthermore, the retaining/removal apparatus has an insulating coating 8 provided on the surface of the sample table 7 on which the substrate W is retained.

With respect to claim 4, the plasma processing system includes a RF feeding apparatus which feeds a high-frequency output for producing plasma at 1 KW (col. 7, lines 42-26).

With respect to claim 7, the plasma processing system includes a detection apparatus 53 for detecting a change in plasma impedance on the basis of variations in the length of the gap between the substrate and the sample table 7, the sample table being lowered 33 under lowering pressure of cooling gas inlet 10 from the sample table, the detection apparatus detecting an electrostatic chucking failure (col. 10, lines 21-53, col. 5, lines 8-15, 32-40).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Appellant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 3, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Deguchi et al. (U.S. 5,665,166) in view of Collins et al. (U.S. 5,874,361).

The teachings Deguchi et al. are discussed above.

Deguchi et al. fails to teach a DC application apparatus for applying a DC voltage to the sample table.

Referring to Figure 1 and column 5, lines 41-51, Collins et al. teaches a plasma processing system having a retaining/removal apparatus 122 having an insulating layer 132, a sample table 114, and a DC application apparatus 102 for applying a DC voltage to the sample table 114. By applying a DC voltage to the sample table 114, opposite polarity charges on the wafer and chuck electrode occur which produce an electrostatic attractive force retaining the wafer to the chuck (col. 7, lines 31-43). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a DC application apparatus for applying a DC voltage to the sample table as taught by Collins et al. as a suitable and equivalent means for retaining a wafer electrostatically.

Deguchi et al. fails to teach a DC voltage within a range of -2.0 KV to 2.0 KV.

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Referring to Figures 3-6, column 5, lines 50-56, and column 9, lines 20-column 10, lines 37, Collins et al. teaches a plasma processing system having a retaining/removal apparatus which outputs a chucking voltage for retaining the substrate and outputs a charge-removal voltage for removal of the substrate in the form of a DC voltage within a range of -200 V to 1000V. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the DC voltage within a range of -200 V to 1000 V in order to adequately develop an electrostatic field that electrostatically retains the wafer upon the sample table and releases the wafer from the sample table.

Deguchi et al. fails to teach that a gap between the substrate and the sample table is changed within a range of 0.5 to 15 mm.

Referring to column 7, lines 18-27, Collins et al. teaches a plasma processing system wherein the gap between the substrate 118 and the sample table 122 within a range of 0 to 5 cm for wafer transferring. Additionally, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a gap between substrate and the sample table within a range of 0 to 5 cm as taught by Collins et al. for wafer transferring.

7. Claim 1 rejected under 35 U.S.C. 103(a) as being unpatentable over Sotozono (Japanese Patent Publication 62-054637) in view of Akihiro (Japanese Patent Publication 07-240458).

Referring to the Drawing 1 and the abstract, Sotozono discloses a plasma processing

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system comprising: a processing chamber 1 into and from which processing gas is inlet 11, 14 and outlet 13; a pair of electrodes 1, 3; a RF feeding apparatus 10 for generating plasma between the pair of electrodes [0026]; a retaining/removal apparatus 3, 6 for retaining a substrate 5 to be processed on and removal from a sample table while one of the pair of electrodes 3 is taken as the sample table; and a detection apparatus for detecting the electrostatic-chucking state of the substrate and for detecting removal state of electrical charges from the substrate, on the basis of variations in impedance arising between the sample table and the substrate. Additionally, the retaining/removal apparatus has an insulating coating 2 provided on the surface of the sample table 3 on which the substrate is retained. Furthermore, the retaining/removal apparatus includes a DC application apparatus 8 for applying a DC voltage to the sample table. Also, the substrate is chucked and retained by the sample table by means of the electrostatic force developing between the substrate and the sample table.

Sotozono fails to teach a pair of electrodes disposed within the chamber.

Referring to Drawing 4 and the abstract, Akihiro teaches a plasma processing system wherein the electrodes 13 and 14 are disposed within the chamber 11. Additionally, it is well known to one of ordinary skill in the art to provide a pair of electrodes within the chamber as a suitable and equivalent means of generating a capacitively coupled plasma. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the electrodes of Sotozono within the chamber as taught by Akihiro since it is a suitable and equivalent means of generating a capacitively coupled plasma.

(11) Response to Argument

Appellant has argued that the Examiner has neglected to explain where Akihiro teaches that the electric discharge sensing equipment 46 operates “on the basis of variations in impedance”, as recited in claim 1. It should be noted that claim 1 simply requires a detection apparatus for detecting the electrostatic-chucking state of the substrate and for detecting removal state of electrical charges from the substrate. The claim does not positively recite and require that the detection apparatus detects impedance. It simply states variations in impedance arise between the sample table and the substrate. Thus, since the abstract and paragraph [0020]-[0021] states that the detection apparatus 41 detects the potential distribution between the substrate and the sample, the result findings yield the detection of the electrostatic-chucking state of the substrate and removal state of electrical charges from the substrate (paragraph [0026]).

Appellant has argued that Examiner has failed to explain how the voltmeter of Akihiro identically describes the claimed impedance detection circuit since voltage and impedance are two different electrical characteristics that are not considered comparable by one having ordinary skill in the art. Firstly, it should be noted that according to page 6, lines 21-23 of appellant’s specification, a voltage probe is used to measure impedance. Next, it is well known in the art to apply a voltage to a sample table so that the sample is held on the sample table by electrostatic forces. Furthermore, a voltage probe is used to detect or measure the applied voltage and then impedance can be determined by a calculation (impedance equals voltage divided by current (impedance= V/I) (see Burns article-Impedance Measurements)). Therefore, when voltage is detected or measured, the impedance can be determined. Impedance and voltage have a direct

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relationship, so when current is constant and voltage increases, hence the impedance increases. Impedance results from voltage and current applied to the sample table and thus it cannot be measured or detected without the use of voltage and current. Furthermore, it should be noted that only claim 1 was rejected under 35 U.S.C. 102 by Akihiro, and since claim 1 fails to require an impedance detection circuit, Akihiro still satisfies the claimed requirement.

Appellant has argued that there is no evidence introduced by the Examiner that would support a finding that current can always be assumed to be constant or that one having ordinary skill in the art would recognize that this feature is necessarily present in the prior art. However, whether the current changes or the voltage changes, the end result is a change in the impedance since voltage and current determine impedance.

Appellant has argued that a factor that affects voltage may not affect impedance and vice versa. As stated above, since ohm's law ($\text{impedance} = V/I$) is very well known in the art, impedance is contingent upon voltage and current.

Appellant has argued that Deguchi fails to state that the abnormality detecting device 53 operates "on the basis of variations in impedance," as recited in claim 1. As stated above, claim 1 simply requires a detection apparatus for detecting the electrostatic-chucking state of the substrate and for detecting removal state of electrical charges from the substrate. The claim does not positively recite nor require that the detection apparatus detect impedance. It simply states variations in impedance arise between the sample table and the substrate. Furthermore,

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according to column 10, lines 46-53, the abnormality detecting device 53 detects the plasma discharge and location of the substrate (i.e. chucking state and removal state of substrate) based on voltage and current. As stated above, when voltage and current are detected, the impedance can be measured.

Appellant has argued that the Examiner has failed to explain how a current monitor and a DC voltage monitor in Deguchi et al. correspond to the claimed impedance detection circuit when current/voltage are not comparable to impedance. However, it is well known to one having ordinary skill in the art that impedance equals voltage divided by current ($Z=V/I$). Therefore, when voltage and/or current is measured, the impedance can be determined. Similarly, impedance results from voltage and current applied to a sample table, thus it cannot be measured or detected without the use of voltage and current. Furthermore, Deguchi et al. clearly states that the plasma impedance (discharge) and sample location is detected through the use of voltage and current monitors (col. 10, lines 45-53).

Appellant has argued that impedance is a function of current and voltage; however, impedance is not the only function of current and voltage since resistance is a function of current and voltage. It should be noted that it is well known in the art that impedance is simply a synonym for resistance (see first paragraph of see Burns article-Impedance Measurements).

Appellant has argued that Collins et al. does not cure the argued deficiencies of

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Deguchi. Accordingly, even if combined, the proposed combination of references would not yield the claimed invention. It should be noted that Deguchi does provide the claimed detection apparatus as discussed above, and Collins et al. was simply applied for the teaching of a DC application apparatus for applying a DC voltage.

Appellant has argued that Examiner has failed to indicate where the claimed detection apparatus can be found in Sotozono. However, the purpose portion of the abstract clearly states that the invention of Sotozono includes a device for detecting voltage and detecting a setting state (chucking state and removal state of substrate) of the chucked work from the voltage value. As previously discussed, it should be noted that according to page 6, lines 21-23 of appellant's specification, a voltage probe is used to measure impedance. Next, it is well known in the art to apply a voltage to a sample table so that the sample is held on the sample table by electrostatic forces. Furthermore, a voltage detector is used to detect or measure the applied voltage and then impedance can be determined by a calculation (impedance equals voltage divided by current ($\text{impedance} = V/I$) (see Burns article-Impedance Measurements)). Therefore, when voltage is measured, the impedance can be determined. Impedance and voltage have a direct relationship, so when current is constant and voltage increases, hence the impedance increases. Impedance results from the voltage and current applied to the sample table and thus it cannot be measured or detected without the use of voltage and current. Furthermore, it should be noted that only claim 1 was rejected under 35 U.S.C. 103 by Sotozono in view of Akihiro, and since claim 1 fails to require an impedance detection circuit, Sotozono in view of Akihiro still satisfies the claimed requirement.

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In summary, obviousness is determined based on the factual inquiries set forth in *Graham v. John Deere Co.*, 148 USPQ 459 (1966), namely determining the scope and content of the prior art, ascertaining the differences between the prior art and the claims at issue, resolving the level of ordinary skill in the pertinent art, and considering objective evidence present in the application indicating obviousness or unobviousness. In the instant appeal, the scope and content of the prior art is best represented by Deguchi et al., and the difference between Deguchi et al. and the claimed invention is the use of a DC application apparatus for applying a DC voltage to the sample table. As this difference is fairly suggested by Collins et al., both it and the claimed invention as a whole would have been prima facie obvious to one of ordinary skill in the art the time the invention was made.

For the above reason, it is believed that the rejections should be sustained.

Respectfully submitted,

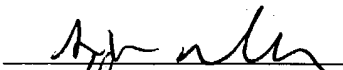
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October 7, 2004

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